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THE NORTH POLAR SEAS.

The Norwegian North Polar Expedition, 1893–1896. *Scientific Results.* Edited by Fridtjof Nansen. Vol. iv. Published by the Fridtjof Nansen Fund for the Advancement of Science. Pp. 232; 32 plates. (London: Longmans, Green and Co., 1904.) Price 21*s.* net.

THE present volume, in continuation of those previously published,[1] contains three articles, which may be noticed in sequence, although the contribution by Dr. Nansen constitutes the principal portion of the work.

In article xi. H. H. Gran deals with "Diatomaceæ from the Ice-floes and Plankton of the Arctic Ocean." It is pointed out that the plankton samples collected on previous expeditions to the Polar seas contained a considerable quantity of algæ, especially diatoms; whereas the samples brought home by Nansen indicate that the deep Polar Sea is deficient both in species and specimens. When found in quantity, they were principally oceanic diatoms; but the author remarks that it is difficult to understand how all the crustaceans (*Calanus finmarchichus,* &c.) that swarm in the upper portions of the Polar Sea can find means of sustaining life. The samples of diatoms taken upon the drift-ice, partly upon the ice-floes and at their edge, partly from channels in the ice, are of greater botanical interest. Most of them must have lived and multiplied on the ice; others, including a few fresh-water forms, were probably transported casually on to the ice. At present little is known concerning the distribution of ice-diatoms, but the samples examined indicate that those of North Siberia and East Greenland are directly connected with one another; and the study of these organisms appears likely to prove of value in determining the drift of the ice.

In article xii. Johan Kiær describes "The Lower Silurian at Khabarova." Fossiliferous calcareous slates were discovered by Nansen in 1893 on the south side of Yugor Strait, near Khabarova, south-west of the Yalmal peninsula. The fossils, though badly preserved, could be identified as belonging to the brachiopods *Leptaena sericea,* Orthis and Strophomena; and to the trilobites Asaphus, Megalaspis, and Remopleurides. They indicate the zone of *Asaphus platyurus,* which belongs to the middle part of the Ordovician.

In article xiii. Nansen contributes an elaborate essay on "The Bathymetrical Features of the North Polar Seas, with a Discussion of the Continental Shelves and Previous Oscillations of the Shore-line." This work, illustrated by 29 maps and profiles, embodies the more important observations and conclusions of the great explorer; and it will be of considerable interest to geologists, as well as to geographers, as some aspects of the subject have been vigorously discussed by Prof. Hull, Dr. J. W. Spencer, Mr. Hudleston, and Sir Archibald Geikie.

As pointed out by the author, the general idea prevailing before the expedition was that the North Polar ocean, between Siberia and North America, was a shallow sea, with a comparatively rapid deposition of sediments carried into it by the Siberian and American rivers, or brought from the coasts by drifting ice. The expedition has shown that the sea occupies a basin with depths approaching 4000 metres, and that at present there is no rapid deposition in it of sediments. Even the dust carried by the winds, or otherwise derived from the atmosphere by precipitation, settles on the floating ice, giving it a dirty brown appearance, and is transported to more southern latitudes, where the ice melts. Proof has likewise been obtained that Franz Josef Land is a group of comparatively small islands, and that probably no extensive land-masses exist to the north of the New Siberian Islands. The deep basin appears to be separated from the Norwegian sea by a shallow suboceanic ridge extending from Spitsbergen to Greenland.

As the *Fram* was heavily laden, Nansen had not encumbered her with the equipment necessary for sounding in very deep water. In the course of his drift across the North Polar basin he soon discovered that his arrangements for sounding were insufficient, and new line had to be made from one of the ship's thick steel-wire cables. Eventually, after much arduous labour, a fairly good sounding line, 4450 metres long, was constructed. According to the soundings thus made, and to those known from other expeditions, a chart has been prepared to show the bathymetrical conditions of the northern seas, but much naturally remains to be done to delineate in detail their submarine contours. The most striking feature in this region is the broad and shallow continental shelf extending northwards from the Eurasian continent, and on which are situated Bear Island, Spitsbergen, Franz Josef Archipelago, and Novaya Zemlya. Continued as it is along the American borders, it forms the most extensive submarine shelf. Davis Strait, with the deep Baffin Bay, and the Norwegian sea with the deep depression of the North Polar basin, form, with their many branches (*e.g.* the Barents Sea), enormous fjords penetrating this platform. Soundings show that its depths are, on the whole, very uniform.

The Siberian continental shelf is regarded as a submerged tract that was originally sculptured with furrows which were the continuations of the sounds, fjords, and valleys of the borderland. These depressions may have been filled up by ground moraines during the Glacial epoch, and also by the deposition of glacial sediments outside the margin of the Siberian ice-sheet, as well as by comparatively recent silting up by deposits from the rivers and shores. Floating ice also assisted in the process.

After describing the American Arctic continental shelf, the author discusses the features of the Barents, Murman, and Kara seas, in which he infers evidence of sculpturing by subaërial agents, fluviatile and glacial. It is interesting to read (p. 28) that "the possibility exists that there has

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[1] Notices of previous volumes appeared in NATURE for June 14, 1900, p. 146; June 13, 1901, p. 151; and December 4, 1902, p. 97.

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been no oscillation of sea level, but that the channels may have been excavated by glaciers to their present position below the sea surface"; and, although the author does not regard this possibility as of much weight, we may recall attention to the interesting suggestion (quoted in NATURE, July 7, p. 218) made by Mr. G. K. Gilbert, from his observations on Alaska, that glaciers, under certain conditions, may excavate beneath sea-level.

The continental shelf of the Norwegian coast is somewhat irregular, the depth of the edge below sea-level differing much between 80m. and 300m., and it is only at a few places that it is as deep as 360m. (200 fms.). The great valleys and fjords of the land are often continued as submarine valleys or fjords across the submerged continental shelf, and at some points they open out at its edge, forming distinct incisions in the continental slope; but they are not as a rule traceable beyond the 400 metres line, and seldom even so far.

The Norwegian submarine channel at the southern end of Norway is regarded as part of the bed of the ancient "Baltic River," which drained the Baltic basin and southern Scandinavian tracts. It is pointed out that Prof. Amund Helland attributed this channel to the erosion of the Scandinavian glacier during the Great Ice Age, and the author, while admitting the influence of that glacier, considers that the present relative depth is due to the adjacent areas having been to a great extent filled up with glacial drift.

After dealing briefly with the regions of the Færoës and Iceland, and with the continental shelves of Britain, France, and North America, the author summarises his views on the general subject of the origin of continental shelves. He discusses also various explanations that have been given.

Regarding the continental shelves as having been shaped prior to the submerged valleys, and considering the great extent of these shelves, and the improbability of regular and extended vertical movements of the lithosphere, the author in 1901 had concluded that they must be due to oscillations of the hydrosphere. He now considers that the general level of the sea must have remained near its present position, despite many oscillations of the land, during the later geological periods. The eroded parts of the continental shelves must have been developed when the shelves were near to sea-level, owing their features partly to conjoint action of subaërial erosion and marine denudation, partly to deposition of terrigenous waste, and even locally to organic agents.

Attention is directed to the extensive coast platforms that occur in part a little below sea-level and extend above it, evidencing small oscillations of the shore-line. The Norwegian coast platform has a surface formed chiefly by solid rocks, and the depressions in it are not filled up to any great extent by waste or glacial drift. This platform was in the author's opinion formed by marine denudation after the fjords and channels now traversing it were cut; but the sculpturing may have been facilitated by the clearing away of débris by glacial action. He believes that marine denudation is most potent when coasts are being slowly submerged; but that the Norwegian platform can hardly have been formed during one period of submergence. These platforms were formed in comparatively recent times, whereas the continental shelves were to a great extent developed during Pliocene and Pleistocene times.

With regard to the oscillations of the land, the author leaves the explanation in a somewhat vague state, observing in conclusion that

> "whatever the causes of the oscillations of the shore-line may have been, the above facts seem to prove that, after each disturbance in the relation between land and sea, the earth's crust has a remarkably strong tendency to return to a certain position of perfect equilibrium, which is probably determined by the buoyancy of the crust floating on the underlying magma."

H. B. W.

FOREST ENGINEERING.

A Manual of Forest Engineering for India. By C. G. Rogers. Vol. i., pp. xx+321, price 6*s*. Vol. ii., pp. xix+267, price 6*s*. Vol. iii., pp. xii+392, price 7*s*. 6*d*. (Calcutta: Office of the Superintendent of Government Printing, India.)

THE manual under notice was written by order of the Indian Government. The work covers the syllabus of the course of study at the Imperial Forest School of Dehra Dun, but, in addition to this, there is much useful information included, giving the book a wider scope than the necessarily limited one of a syllabus of systematic instruction. The manual has been divided into eight parts. The separate parts deal with the following subjects:—(1) building materials; (2) building construction; (3) road making; (4) bridges; (5) transport of timber; (6) wells; (7) construction of embankments and water channels, river training works; (8) demarcation of forests.

In part i. we have a vast amount of information of the most useful kind on such materials as stone, bricks, tiles, lime, and timber. The source, strength, durability, preparation, and preservation of those various materials have been fully dealt with, each under its own heading. The last section of this part is devoted to carpentry and joinery, which, although not coming strictly under the heading of building materials, fit very well into this place as the most convenient for reference. Part ii., which is devoted to building construction, includes much eminently sound and useful information concerning foundations, walls, arches, floors, stairs, roofs, &c. All the best authorities have been consulted, and no suggestion or recommendation has been made which cannot be easily and successfully put into practice by the forester with such materials as he may find ready to hand and most suitable for his purpose, situated as he often is in out-of-the-way parts of the world, where not only the advice of a specially trained engineer, but also manufactured building materials are unobtainable. These two part complete the first volume of the manual.

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